WHAT IS CLAIMED IS:

1. A method for making a series of nanoscale microstructures comprising the steps of:

(1) forming a block copolymer containing a plurality of first polymer blocks and a plurality of second polymer blocks, wherein at least said first polymer blocks are chiral polymer blocks exhibiting chirality, and said first and second polymer blocks are capable of being subject to a micro-phase separation and said first polymer blocks have a volume fraction ranging from 10 to 90%;

(2) causing a microphase separation in said chiral block copolymer.

2. The method for making a series of nanoscale microstructures according to claim 1, wherein said chiral block copolymer is poly(styrene)-poly(L-lactide) (PS-PLLA) chiral block copolymer, said first polymer is poly(L-lactide), and said second polymer is polystyrene.

3. The method for making a series of nanoscale microstructures according to claim 1, wherein said chiral block copolymer is poly(4-vinylpyridine)-poly(L-lactide) (P4VP-PLLA) chiral block copolymer, said first polymer is poly(L-lactide), and said second polymer is pol(4-vinylpyridine).

4. The method for making a series of nanoscale microstructures according to claim 1, wherein said poly(L-lactide) has a volume fraction ranging from about 20% to about 49%.

5. The method for making a series of nanoscale microstructures according to claim 1, wherein said nanoscale microstructures are a series of helical microstructures.

6. The method for making a series of nanoscale microstructures according to claim 1, wherein

said nanoscale microstructures are a series of cylindrical microstructures each with a hexagonal crossection.

7. The method for making a series of nanoscale microstructures according to claim 2, wherein said poly(styrene)-poly(L-lactide) (PS-PLLA) chiral block copolymer is prepared using a polymerization process comprising the following steps:

(1) mixing styrene with BPO and 4-OH-TEMPO to form 4-hydroxy-TEMPO-terminated polystyrene; and

(2) mixing said 4-hydroxy-TEMPO-terminated polystyrene with $[(\eta_3\text{-EDBP})Li_2]_2[(\eta_3\text{-}{}^n\text{Bu})Li(0.5Et_2O)]_2$ and L-lactide in an organic solvent to form said poly(styrene)-poly(L-lactide) chiral block copolymer.

8. The method for making a series of nanoscale microstructures according to claim 7, wherein said polymerization process is a living polymerization in which monomers are sequentially added to a polymerization mixture.

9. The method for making a series of nanoscale microstructures according to claim 1, wherein said phase separation of said poly(styrene)-poly(L-lactide) chiral block copolymer is achieved through crystallization.

10. An object containing a series of repeating nanoscale microstructures formed in a substrate, said objected being formed using a process comprising the steps of:

(1) forming a block copolymer containing a plurality of first polymer blocks and a plurality of second polymer blocks, wherein said first polymer blocks are chiral blocks, wherein said first polymer blocks have a volume fraction ranging from 10 to 90%;

(2) causing a phase separation in said block copolymer.

11. The method for making a series of nanoscale microstructures according to claim 11, wherein said block copolymer is a poly(styrene)-poly(L-lactide) chiral block copolymer, and said first polymer blocks are poly(L-lactide) blocks and said second polymer blocks are polystyrene blocks.

12. The method for making a series of nanoscale microstructures according to claim 11, wherein said block copolymer is a poly(4-vinylpyridine)-poly(L-lactide) chiral block copolymer, and said first polymer blocks are poly(L-lactide) blocks and said second polymer blocks are poly(4-vinylpyridine) blocks.

13. The method for making a series of nanoscale microstructures according to claim 9, wherein said poly(L-lactide) has a volume fraction ranging from about 20% to about 49%.

14. The method for making a series of nanoscale microstructures according to claim 11, wherein said nanoscale microstructures are a series of helical microstructures.

15. The method for making a series of nanoscale microstructures according to claim 11, wherein said nanoscale microstructures are a series of cylindrical microstructures each with a hexagonal crossection.

16. The method for making a series of nanoscale microstructures according to claim 12, wherein said poly(styrene)-poly(L-lactide) (PS-PLLA) chiral block copolymer is prepared using a polymerization process comprising the following steps:

(1) mixing styrene with BPO and 4-OH-TEMPO to form 4-hydroxy-TEMPO-terminated

polystyrene; and

(2) mixing said 4-hydroxy-TEMPO-terminated polystyrene with $[(\eta_3\text{-EDBP})Li_2]_2[(\eta_3\text{-}^n\text{Bu})Li(0.5Et_2O)]_2$ and L-lactide in an organic solvent to form said poly(styrene)-poly(L-lactide) chiral block copolymer.

17. The method for making a series of nanoscale microstructures according to claim 17, wherein said polymerization process is a living polymerization in which monomers are sequentially added to a polymerization mixture.

18. The method for making a series of nanoscale microstructures according to claim 12, wherein said phase separation of said poly(styrene)-poly(L-lactide) chiral block copolymer is achieved through crystallization.

19. A nanoscale process comprising the steps of:

(1) obtaining an object, said object contains a series of nanoscale microstructures;

(2) wherein said nanoscale microstructures are formed using a process containing the following steps:

(A) forming a block copolymer containing a plurality of first polymer blocks and a plurality of second polymer blocks, wherein said first polymer blocks are chiral blocks, wherein said first polymer blocks have a volume fraction ranging from 20 to 49%;

(B) causing a phase separation in said block copolymer.

20. The nanoscale process according to claim 19, wherein said block copolymer is a

poly(styrene)-poly(L-lactide) chiral block copolymer, and said first polymer blocks are poly(L-lactide) blocks and said second polymer blocks are polystyrene blocks.